CLAIMS

We Claim:

1. A method for verifying combustion in a burner of a fuel reformer during warm up and steady operation, the method comprising the steps of:

detecting for flame within a burner of a fuel reformer during an initial warm-up stage of operation of a fuel reformer;

proceeding with operation of the fuel reformer if a flame is detected within the burner;

monitoring a temperature of a catalyst within the burner to determine the occurrence of flameless catalytic combustion;

proceeding with operation of the fuel reformer if a predetermined temperature is achieved by the catalyst within the burner; and

producing a burner exhaust.

- 2. The method of Claim 1, wherein the step of detecting for flame is accomplished by at least one flame detector.
- 3. The method of Claim 2, wherein the at least one flame detector is selected from the group consisting of a flame ionization detector, an ionization/rectification flame detector, a light-based flame detector, an ultraviolet light detector, a photoelectric eye, a visible light detector, an infrared detector, or a combination thereof.
- 4. The method of Claim 1, wherein the step of monitoring a temperature is accomplished by at least one temperature sensor.
- 5. The method of Claim 4, wherein the at least one temperature sensor is selected from the group consisting of thermocouples, thermistors, resistive temperature devices, thermometers, infrared detectors, and a combination thereof.
- 6. The method of Claim 1, further comprising the step of determining the completeness of combustion after the step of producing a burner exhaust.

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- 7. The method of Claim 6, wherein the step of determining the completeness of combustion comprises the step of sensing for oxygen in the burner exhaust to produce a reading, wherein a positive reading for oxygen indicates complete combustion.
- 8. The method of Claim 6, wherein the step of determining the completeness of combustion comprises the step of sensing for hydrocarbon fuel in the burner exhaust to produce a reading, wherein a negative reading for hydrocarbon fuel indicates complete combustion.
- 9. The method of Claim 7, wherein the step of sensing for oxygen is accomplished by an oxygen sensor.
- 10. The method of Claim 9, wherein the oxygen sensor comprises an automotive-type oxygen sensor.
- 11. The method of Claim 8, wherein the step of sensing for hydrocarbon fuel is accomplished by a hydrocarbon sensor.
- 12. The method of Claim 1, wherein the predetermined temperature of the catalyst within the burner is above the temperature at which the catalyst operates as a flameless oxidation catalyst.
- 13. The method of Claim 12, wherein the step of monitoring a temperature comprises the steps of:

providing at least two temperature sensors within the burner;
comparing an output of each temperature sensor; and
registering a "system error" if the difference between any two outputs exceeds a
predetermined value.

14. The method of Claim 6, further comprising the step of controlling a burner input based on the completeness of combustion.

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- 15. The method of Claim 7, further comprising the step of controlling a burner input based on the reading for oxygen in the burner exhaust.
- 16. The method of Claim 8, further comprising the step of controlling a burner input based on the reading for hydrocarbon fuel in the burner exhaust.
- 17. A burner assembly associated with a fuel reformer designed to combust fuel in a manner in which lean combustion of the fuel can be verified, the burner assembly comprising:

an outer shell housing a combustion chamber comprising a burner;

- a catalyst bed situated within the combustion chamber;
- a mixing zone in fluid communication with the combustion chamber;

an air inlet and a fuel inlet in communication with the mixing zone, wherein a supply of air through the air inlet and a supply of fuel through the fuel inlet are mixed within the mixing zone;

an exhaust outlet in fluid communication with the combustion chamber, wherein an exhaust stream is discharged from the combustion chamber through the exhaust outlet;

- a flame detector positioned such that it is capable of detecting the existence of flame in the combustion chamber;
- a temperature sensor positioned such that it is capable of monitoring temperature of the catalyst bed; and

an exhaust detector positioned downstream of the catalyst bed and capable of detecting at least one of either oxygen or hydrocarbon in the exhaust stream.

- 18. The burner assembly of Claim 17, further comprising a controller for controlling at least one of either the supply of fuel and the supply of air admitted to the mixing zone.
- 19. The burner assembly of Claim 17, wherein the flame detector is selected from the group consisting of a flame ionization detector, an ionization/rectification flame detector, a light-based flame detector, an ultraviolet light detector, a photoelectric eye, a visible light detector, an infrared detector, or a combination thereof.

- 20. The burner assembly of Claim 17, wherein the temperature sensor is selected from the group consisting of thermocouples, thermistors, resistive temperature devices, thermometers, infrared detectors, and a combination thereof.
- 21. The burner assembly of Claim 17, wherein the exhaust sensor comprises a hydrocarbon sensor for sensing hydrocarbons in the exhaust stream to produce a reading, wherein a negative reading for hydrocarbon indicates complete combustion.
- 22. The burner assembly of Claim 17, wherein the exhaust sensor comprises an oxygen sensor for sensing oxygen in the exhaust stream to produce a reading, wherein a positive reading for oxygen indicates complete combustion.
- 23. The burner assembly of Claim 22, wherein the oxygen sensor comprises an automotive-type oxygen sensor.